

**Quantitative indicators and life history
implications of environmental stress on
sturgeon**

#0025

Technical Panel Review

Proposal Name: Quantitative indicators and life history implications of environmental stress on sturgeon

Applicant Organization: Davis, California University of

Principal Lead Investigator(s):

Kueltz, Dietmar
Doroshov, Serge
Hung, Silas
Cech, Joseph
Gingras, Marty

Amount Requested: \$1,008,881

TSP Panel Summary of Findings:

This is a resubmission of a 2004 CALFED proposal rated as 'superior.' This highly-qualified research team submitted a well-written proposal. On the surface, it appears to be a useful integration of a variety of techniques to examine how interacting stressors lead to physiological/developmental effects and toxicity/proteomics responses in the field and lab. Concerns regarding the proposal:

1. The design of certain components of the project were questioned (e.g., there may be insufficient treatments to examine the interactions of stressors), and it is unclear to what extent various components will truly integrate (however, qualitative integration may be sufficient).
2. In addition, given that green sturgeon rearing may not fully succeed, it is unclear how the researchers will adapt their study under this eventuality (in fact most of the methods list "sturgeon" as the study organism without detailing which species; one would assume that for these different analyses, sample sizes should be twice what is described in the text [i.e., 2 species]; researchers make strong arguments for looking at both species; if only one species is examined, then the budget should at least be

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revisited).

3. Finally, it is unclear how well the proposed research fits with CALFED's 2006 PSP. That is, while it involves 'Integration' it does not utilize 'Existing Data' or 'Models' for synthesis. In addition, direct relationships between this work and system ecology and population-level effects are lacking. How would management use the results from this study? How does it tie in with community and population ecology? It is not made clear in the proposal. This shouldn't require much more effort to translate to community and population level. However, this basic research can provide building blocks for this sort of synthesis in the future.

Dose range (4 concentrations) may not be sufficient.

Relevance to PSP Topic Areas:

Moderate

TSP Technical Rating:

Superior

TSP Funding Recommendation:

Fund w/conditions

TSP Amount Recommended: \$700,000

Conditions:

1. The research team should use/rent an existing mass spectrometer (adjusted funded amount reflects this change).
2. Since the various tasks outlined in the proposal build on each other, it is critical that they adequately mesh. It is not always clear that all components of the project will involve both white and green sturgeon. The proposal should be adjusted to clarify this. It is critical that both species will be examined for all tasks.
3. In its current form, the proposal does not adequately link

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stressor effects to population and community-level effects. The proposal team must add a component to quantitatively (ideally with a model) link physiological/biochemical effects and tissue burden of wild fish to consider population level effects. Further, the scope of work and individuals involved with this component must be approved by CALFED.

External Technical Review #1

Proposal Title: Quantitative indicators and life history implications of environmental stress on sturgeon

Proposal Number: 0025

Proposal Applicant: Davis, California University of

Purpose

Comments	The goals, objectives, and hypotheses are consistent and clearly stated. The investigators make a very good case for the relevance and timeliness of the proposed work. In fact, I am a little surprised that this study was not funded during the first review process. This integrated, comprehensive research program will add to the knowledge base, especially the proteomics work. Some sections describe good, solid work that will add less new knowledge. Unquestionably, novel information will be generated.
Rating	Superior

Background

Comments	The proposal does an excellent job with all of the issues asked about here.
Rating	Superior

Approach

Comments	The approach is well designed and appropriate. As a minor point, I was a little disappointed in the general reliance on the conventional ANOVA designs. However, they will get the job done. I suggest to the investigators that they sit down with a few statisticians before beginning to see if the designs can be further enhanced. It would be nice to see some a priori power analyses. Regardless, the approach is
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External Technical Review #1

	excellent.
Rating	Superior

Feasibility

Comments	The approach, expertise, and designs make it clear that the investigators will succeed, providing useful information.
Rating	Superior

Budget

Comments	I am not the best judge of costs for the proteomics and such work. However, the cost per unit of useful information to be generated in this study seems excellent in my opinion.
Rating	Above Average

Relevance To CALFED

Comments	The investigators do an extremely good job of highlighting the utility of the work to CALFED. I have reviewed many CALFED proposals in the past and find this one to be one of the most convincing.
Rating	Superior

Qualifications

Comments	This is one of the strongest aspects of the proposal. Diverse experts will come together in what appears to be a useful and coordinated effort. The resources and infrastructure are clearly in place.
Rating	Superior

External Technical Review #1

Overall Evaluation Summary Rating

Comments	There is no question in my mind that this is an excellent proposal, addressing issues relevant to CALFED. I have no hesitation recommending it for funding.
Rating	Superior

External Technical Review #2

Proposal Title: Quantitative indicators and life history implications of environmental stress on sturgeon

Proposal Number: 0025

Proposal Applicant: Davis, California University of

Purpose

Comments	Goals, objectives and hypotheses are clearly stated and internally consistent. The idea is timely and important. With sturgeon species' importance to the CALFED program, and both organo-Se and organo-Hg in the system potentially affecting white and green sturgeon, understanding effects at the protein level provides important insight in the issue while also providing biomarkers that can be used in assessments of the Hg and Se effects. The study is indeed justified relative to existing knowledge. The same type of research has not been done to my knowledge, while this field of research has developed to the point where proteomics approaches are now very feasible and can be tied to practical applications such as assessments and biomonitoring. This is a research project that will add to the base of knowledge and generate novel information, methodology and approaches. If the research delivers what it promises (though the approach may fall short - see below), then it would provide important insight and new tools.
Rating	Superior

Background

Comments	The underlying basis for the proposal is well documented, and information needed to understand the basis for the proposed work is included. In principal, it is a great idea to combine stress's physiological effects, developmental effects, toxicity and proteomic
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External Technical Review #2

	<p>changes, and to combine laboratory exposures with data on field-collected fish - and to do this for the combination of selenium and methylmercury. A proteomics approach (the meat of this proposal) is a very promising one and would indeed benefit a lot from combining the study of changes in the proteome with studying physiological and other toxicological effects (and tying this to population-level changes would of course be highly desirable). Similarly, studying the interaction between selenium, methylmercury, temperature and salinity is very important for understanding the anthropogenic influences on species such as white and green sturgeon.</p>
<p>Rating</p>	<p>Superior</p>

Approach

<p>Comments</p>	<p>While purpose and background sections highlight the importance of this project, the approach falls short in meeting the objectives of this project. The different components of the project do not mesh sufficiently with each other, the number of treatments for the four stressors (temperature, salinity, selenium and mercury treatments) is often insufficient for really looking at interactions between these factors, and the salinity and temperature stressors are not fully integrated in the design (applied following the metal(oid) exposures rather than simultaneous). While I can see that the amount of work involved for the various components of the research (especially with the proteomics) poses limitations to the number of treatments that can be studied, I believe that a less ambitious design (looking at fewer variables but in a more complete design) would be a better approach. With respect to the parts not fully meshing: Task 2 looks at only a subset of the variables (temp and Se + temp stress), and the field component (Task 5) includes Se analyses but not Hg analyses. The toxicokinetics part uses one Se concentration, and a combination of one Se concentration and one MeHg concentration. And it will</p>
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External Technical Review #2

	<p>be difficult to interpret interaction between Se and Hg with Se-alone and Se+Hg treatments but no Hg-alone treatments. The temperature and salinity stress components not only suffer from not being applied simultaneous with the metals, but are also limited by being studied at only one temp change (18 to 25 °C) and one salinity change (0 to 30 ppt). Thus while a major goal is to "correlate data obtained in task 6 (proteomic analyses) with the data obtained in tasks 2-5", the specific approach and experimental design are such that it will often not be possible to correlate data from different tasks.</p>
Rating	Inadequate

Feasibility

Comments	<p>The approach is fully documented and technically feasible, though problems with the design/approach will mean that it is not all that likely that the overall goal of the project will be attainable. The scale of the project should be within the grasp of the authors/researchers - which are very experienced and highly qualified.</p>
Rating	Above Average

Budget

Comments	<p>The budget is generally clear with respect to the costs of each task. The total budget is very substantial (just over 1Mil), with more than half going to the proteomics task. Of this, 300K goes to one piece of equipment (sequencing MS) and it may be more economical to have those specific analyses contracted out rather than purchasing the equipment.</p>
Rating	Sufficient

External Technical Review #2

Relevance To CALFED

Comments	This proposal was initially developed for the 2004 CALFED Science PSP. While the authors state that the proposal was modified to focus on the priorities of the current PSP, it does not appear to be a great fit to this current PSP. The proposal has some links with the "Environmental Water" and "Changing Environment", and "Habitat Availability" topics, but these links are not very strong. The proposal does address some other priorities, such as being an interdisciplinary project
Rating	Sufficient

Qualifications

Comments	The team put together for this project has an extensive and solid track record and well qualified to conduct the proposed research.
Rating	Superior

Overall Evaluation Summary Rating

Comments	Great idea and overall goals; this type of research is important. But the topic is not a great fit with the current PSP and the approach has some problems that would probably keep the project from attaining its goals.
Rating	Above Average

External Technical Review #3

Proposal Title: Quantitative indicators and life history implications of environmental stress on sturgeon

Proposal Number: 0025

Proposal Applicant: Davis, California University of

Purpose

Comments	The authors spent a considerable amount of effort explaining the goals and objectives of the study. The proposed work entails multiple areas related to environmental stress and impacts to sturgeon. This information is very timely as the North American green sturgeon population in the Central Valley was recently listed as threatened under the ESA by NMFS. Some work has been done on this subject, however, this proposed work will continue pinpointing the key factors and stressors adding important information to our green sturgeon knowledge base. My knowledge of the techniques and equipment in this proposal is not sufficient to determine if the project utilizes novel methodologies, however, I suspect it does as indicated in the proposal.
Rating	Superior

Background

Comments	I found the conceptual model to be a key component of the proposal as it explained the basis for the work. The investigators also inserted considerable information in the project background and task descriptions helping to justify the basis of the work. Given the space limitations of proposals, this was done very well.
Rating	Above Average

Approach

<p>Comments</p>	<p>The approach incorporates well known scientific experts in developmental, biochemical, physiological, ecological, behavioral, and molecular biology, resulting in a comprehensive assessment. The proposal exhibited excellent communication across these disciplines and tasks. Results of this work will be helpful to management agencies as they will help pinpoint the current condition of sturgeon and impacts of a variety of well know stressors on populations. These results will likely be incorporated into green sturgeon viability assessments for NMFS recovery efforts and other green sturgeon management related topics. Additional information will be useful in determining the relative impact of various threats to green sturgeon. Finally, the results will be helpful to manage the population for recovery.</p> <p>The investigators intend to disseminate results in peer-reviewed journals and at professional meetings.</p>
<p>Rating</p>	<p>Superior</p>

Feasibility

<p>Comments</p>	<p>Many of the investigators have greater than 100 publications related to this topic and clearly are capable of the work. There appears to be a balance of well documented approaches and some novel work with a good likelihood of success (I lack expertise in this category).</p>
<p>Rating</p>	<p>Superior</p>

Budget

<p>Comments</p>	<p>The budget is clear and simple to follow. It appears adequate.</p>
<p>Rating</p>	<p>Above Average</p>

Relevance To CALFED

Comments	As the authors describe in the proposal, the work will address the effects of environmental water quality on a high priority species assisting with recovery needs, how the biological processes of sturgeon are affected by key environmental variables, and the effects of climate change (related to how salinity and temperatures). These are three of the four 2006 Science Program PSP "Priority Research Topics." The proposal shows very thorough integration and utilization of experts in a variety of fields. This information will be very useful to CALFED resource managers and policy makers.
Rating	Superior

Qualifications

Comments	Past work by many of the investigators has shown to be of high scientific value - several of which have world-wide reputations in their respective fields. As mentioned previously, there are literally hundreds of published by these authors in topics related to this work. Yes, this team has the ability to conduct this work and manage the funds.
Rating	Superior

Overall Evaluation Summary Rating

Comments	<p>It is difficult to find any weaknesses in this proposal - definitely the best I have read and should be used as a guideline for future PSPs. A few topics I did not cover above:</p> <ol style="list-style-type: none"> 1. Many of the authors detailed the statistical procedures used - some more than others. This was very helpful. 2. It was unclear whether or not the data from this project will be independently backed up.
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External Technical Review #3

	Thank you for the opportunity to review.
Rating	Superior